COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elective course F: Modeling of thermal processes

Course

Field of study

Power Engineering

Area of study (specialization)

Industrial Thermal Power Engineering

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

4/7

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

15

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

dr inż. Damian Joachimiak

Responsible for the course/lecturer:

dr inż. Magda Joachimiak

Prerequisites

- Knowledge of the thermodynamics, fluid mechanics

- The ability of effective self-education in the field related to the chosen field of study

- Is aware of the need to expand their competences, readiness to cooperate within a team. Awareness of the need to expand their competences in the field of engineer work.

Course objective

Acquainting with the mathematical description of thermal processes in a steady state and undefined. Analysis of behavioral equations. Introduction to numerical calculation methods, discretization methods. Acquiring the ability to develop assumptions necessary for the design or modernization of systems in the area of thermal energy.

Course-related learning outcomes

Knowledge

1. Has structured and theoretically founded knowledge of the use of thermodynamics, fluid mechanics, heat exchange elements needed to model thermodynamic and flow phenomena.

2. Has structured knowledge in programming in the freeFEM ++ environment

3. Knows the basic concepts of energy management and the use of commercial programs in this area to solve engineering problems.

Skills

1. Is able to compare design solutions of elements and systems in the field of modeling of thermal processes.

2. Is able to independently design simple issues of heat transfer in elements of energy machines.

Social competences

Is aware of the importance and understands the non-technical aspects and effects of the power engineering engineer, including its impact on the environment and the associated responsibility for decisions; is ready to fulfill social obligations, co-organize activities for the social environment and initiate activities for the public interest.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- Knowledge acquired as part of the lecture is verified by a final exam consisting of 6 to 9 questions with various points depending on their level of difficulty. Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.

In the initial part of the class, issues are first discussed on the blackboard and then implemented in groups - practical exercises.

- Skills acquired as part of the project classes are verified on the basis of short presentations during the semester, questions from the teacher and on the basis of the final project developed. Passing threshold: 50% of points.

Programme content

Mathematical description of thermal processes such as: steady and unsteady heat flow, fluid flow; free convection, forced convection, water vapor condensation. Introduction to numerical fluid mechanics. Finite difference method, differential schemes. Discussion of discretization methods. Familiarization with commercial programs in the field of CFD (Computational Fluid Dynamics) such as Fluent and programs from the oupennsource group - FreeFem ++. Discussion of methods for generating meshes (structural and unstructured). Getting to know the possibilities of using UDF in the Fluent program. Overview of boundary layer theory, review of turbulence models.

Teaching methods

1. Lecture: blackboard with multimedia presentation.

2. Project classes: discussing theory and assumptions for classes on the board and performing tasks given by the teacher, independent work on the design task.

Bibliography

Basic

1. S. Wiśniewski - Wymiana ciepła

2. Prosnak W. J., Równania klasycznej mechaniki płynów

3. S. Perycz – Turbiny parowe i gazowe, Wyd. Pol. Gdańskiej,1982

4. Puzyrewski R., Podstawy Mechaniki Płynów

5. T. Chmielniak – Technologie energetyczne, Wyd. Pol. Śląskiej,2004

6. S. Wiśniewski, Termodynamika Techniczna

7. FreeFem++, Frederic Heft, http://www.freefem.org/ff++

Additional

1. Prosnak W. J., Mechanika Płynów, Tom I

2. Prosnak W. J., Mechanika Płynów, Tom II

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	68	3,0
Student's own work: literature studies, preparation for classes; preparation for exam [1]	50	2,0

[1] delete or add other activities as appropriate